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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/523,623	02/14/2006	Alain Bergel	355901-0109	5868

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FOLEY & LARDNER LLP  
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EXAMINER
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ESSEX, STEPHAN J

ART UNIT	PAPER NUMBER
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1795

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11/27/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/523,623	<b>Applicant(s)</b> BERGEL ET AL.	
	<b>Examiner</b> STEPHAN ESSEX	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 7/14/2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2/4/2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. The applicant's amendment filed on July 14, 2009 was received. Claims 1, 7, 8 and 13-17 were amended.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3, 5-8 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Zeikus et al. (hereinafter "Zeikus") (U.S. Pat. No. 6,270,649).

Regarding claims 1, 5 and 18, Zeikus teaches a method of using neutral red and cells or enzymes to produce electricity comprising the steps of (a) providing an electrochemical bioreactor system (fuel cell) having a cathode compartment equipped with a cathode and an anode compartment equipped with an anode, the cathode and anode compartments being separated by a cation selective membrane; and (b) placing a suitable amount of neutral red and a biological catalyst (biofilm) in the cathode compartment (medium capable of causing the growth of biofilms). To maximize the

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interconversion of biochemical and electrical energy, the biological catalyst is immobilized (formed) on the cathode. The method of the invention further comprises the step of delivering to the cathode an electric current suitable in strength to cause the reduction of at least a portion of oxidized neutral red in the cathode compartment (polarization potential) (see col. 5, lines 55-56; col. 6, lines 35-57; figure 1).

Regarding claims 2 and 3, Zeikus teaches that the cathode compartment is filled with a catholyte material (medium capable of causing growth of the biofilm) such as a phosphate buffer comprising saline (seawater) (see col. 8, lines 35-48).

Regarding claim 6, Zeikus teaches that reduction of neutral red requires a potential (polarization potential)  $E_o' = -0.325$  volts.

Regarding claims 7 and 8, Zeikus teaches an electrochemical bioreactor system (fuel cell) having a cathode compartment equipped with a cathode and an anode compartment equipped with an anode, the cathode and anode compartments being separated by a cation selective membrane, wherein the cation compartment is filled with a suitable amount of neutral red and a biological catalyst (biofilm). To maximize the interconversion of biochemical and electrical energy, the biological catalyst is immobilized on the cathode. NADH and ferricyanide may be used as electron donor (reducing agent) and electron acceptor (oxidant), respectively. Zeikus further teaches that the cathode compartment is oxygenated by constant air bubbling (see col. 5, lines 55-56; col. 6, lines 35-57; col. 9, lines 36-39; col. 16, lines 23-24; figure 1).

***Claim Rejections - 35 USC § 103***

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus as applied to claims 1-3, 5-8 and 18 above, and further in view of Chaix (U.S. Pat. No. 7,122,273).

Regarding claim 4, Zeikus is silent to the water being circulating water.

Chaix teaches a fuel cell with electrodes immersed in water, wherein the water is circulating water (col. 5, lines 4-9). It would have been obvious to one of ordinary skill in the art to modify the fuel cell of Zeikus with the circulating water of Chaix because the circulating water allows for effective cooling of the fuel cell (see Chaix, col. 4, lines 48-51).

6. Claims 9, 10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus as applied to claims 1-3, 5-8 and 18 above, and further in view of Worth et al. (hereinafter "Worth") (U.S. Pat. No. 6,379,828).

Regarding claims 9 and 12, Zeikus teaches that the cathode compartment is filled with a phosphate buffer comprising saline (water) and is oxygenated by (sparged with) constant air (oxidizing agent) bubbling (see col. 8, lines 35-46; col. 16, lines 23-24).

Zeikus is silent to sparging a stream of reducing agent into the anode compartment.

Worth teaches supplying oxidant and/or fuel (reducing agent) in a fuel cell by sparging means (see col. 4, lines 39-41). It would have been obvious to one of ordinary

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skill in the art at the time the invention was made to have provided fuel sparging means for the bioreactor of Zeikus because Worth teaches that the sparging means delivers bubbles of a uniform size allowing for controlled fuel delivery (see col. 4, lines 44-46).

Regarding claim 10, Zeikus teaches that the phosphate buffer comprising saline (water) and neutral red promotes catalytic cell growth (capable of regenerating the biofilm) (see col. 6, lines 59-64; col. 7, lines 3-11, 39-50; col. 8, lines 44-53).

7. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus and Worth applied to claims 9, 10 and 12 above, and further in view of Chaix (U.S. Pat. No. 7,122,273).

Regarding claim 11, Zeikus is silent to the water being circulating water.

Chaix teaches a fuel cell with electrodes immersed in water, wherein the water is circulating water (col. 5, lines 4-9). It would have been obvious to one of ordinary skill in the art to modify the fuel cell of Zeikus with the circulating water of Chaix because the circulating water allows for effective cooling of the fuel cell (see Chaix, col. 4, lines 48-51).

8. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus and Worth as applied to claims 9, 10 and 12 above, and further in view of Yoshizawa et al. (hereinafter "Yoshizawa") (U.S. Pub. No. 2003/0162063A1).

Regarding claim 13, Zeikus does is silent to the gas stream or streams having moisture content such that it allows the biofilm to be regenerated.

Regarding claim 14, Zeikus does not teach a stream of water that coexists in parallel with the gas streams feeding the compartment or compartments provided with a biofilm.

Yoshizawa teaches that is known in the art to humidify gas streams in a fuel cell using pure water (see paragraph 3). Water therefore necessarily coexists in parallel with the gas streams feeding the compartment provided with the biofilm. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the fuel cell of Zeikus with the humidification system of Yoshizawa in order to maintain moisture levels in the fuel cell and improve fuel cell efficiency.

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus as applied to claims 1-3, 5-8 and 18 above, and further in view of Sun et al. (hereinafter "Sun") (U.S. Pub. No. 2003/0087144A1).

Regarding claim 15, Zeikus teaches that suitable materials for the electrodes include metallic materials. Zeikus does not explicitly teach stainless steel, aluminium, nickel or titanium alloys.

Sun teaches a cathode electrode coating comprising titanium (see paragraph 120). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided a titanium cathode electrode coating in the bioreactor system of Zeikus because the selection of a known material, which is based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art. See *In re Leshin*, 125 USPQ 416 (CCPA 1960) (see MPEP § 2144.07).

12. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus as applied to claims 1-3, 5-8 and 18 above, and further in view of Kim et al. (hereinafter "Kim") (U.S. Pat. No. 5,976,719).

Regarding claim 16, Zeikus teaches that the cathode compartment is is oxygenated by constant air (oxidizing agent, oxygen) bubbling (see col. 8, lines 35-46; col. 16, lines 23-24).

Zeikus is silent to the reducing agent being hydrogen.

Kim teaches a biofuel cell wherein hydrogen is used as a fuel (reducing agent) (see col. 9, lines 63-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided hydrogen as an electron donor in the bioreactor or Zeikus because the selection of a known material, which is based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art. See *In re Leshin*, 125 USPQ 416 (CCPA 1960) (see MPEP § 2144.07).

13. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zeikus as applied to claims 1-3, 5-8 and 18 above.

Regarding claim 17, Zeikus teaches an electrode coated on at least part of its surface with a biological catalyst (biofilm) (see col. 5, lines 55-56; col. 6, lines 35-57; figure 1).

Zeikus does not teach that this is done before the electrode is placed in the fuel cell. There are however, two predictable solutions regarding when to coat the



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electrode. It may be done either before or after the electrode is placed in the fuel cell.

The Supreme Court has ruled that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp.” An obviousness determination is not the result of a rigid formula disassociated from the considerations of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a reasonable expectation for success, is likely to be obvious to a person of ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d ’385, 1395-97 (2007) (see MPEP § 2143, E.). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have tried to coat the electrode before the electrode was placed in the fuel cell with a reasonable expectation that doing so would result in a successfully coated electrode.

### ***Response to Arguments***

10. Applicant’s arguments, filed July 14, 2009, with respect to the rejection(s) of claim(s) 1-18 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of newly found prior art references.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHAN ESSEX whose telephone number is (571) 270-7866. The examiner can normally be reached on Monday - Friday, 7:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on (571) 272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SJE

/Dah-Wei D. Yuan/  
Supervisory Patent Examiner, Art Unit 1795